



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material[®] 1883a

Calcium Aluminate Cement

This Standard Reference Material (SRM) is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of cements and materials of similar matrix. A unit of SRM 1883a consists of four sealed vials, each containing approximately 5 g of calcium aluminate cement.

Certified Values: The certified values for seven elements, expressed in their oxide forms as mass fractions [1] on an as-received basis, are provided in Table 1. A NIST certified value is a value for which NIST has the highest confidence in its accuracy, in that all known or suspected sources of bias have been investigated or accounted for by NIST. The certified values listed are based on the results of analyses performed at NIST and at Construction Technology Laboratories, Inc. (CTL) using x-ray fluorescence spectrometry, atomic absorption spectrometry, and reference methods given in ASTM C 114-97 Standard Test Methods for Chemical Analysis of Hydraulic Cement [2]. Homogeneity testing was performed using x-ray fluorescence spectrometry.

Reference Values: The reference values for an additional three elements, expressed in their oxide forms as mass fractions on an as-received basis, are provided in Table 2. Reference values are noncertified values that represent a best estimate of the true value; however, the values, which are based on determinations done by a single reliable method, do not meet the NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision and may not include all sources of uncertainty.

Information Values: Information values for Loss on Ignition (LOI), P_2O_5 , and Mn_2O_3 , are provided in Table 3. These are noncertified values with no uncertainties reported as there is insufficient information to make an assessment of the uncertainties. The information values are given to provide additional characterization of the material.

Expiration of Certification: The certification of this SRM is valid until **01 August 2014**, within the uncertainty specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see Use and Handling). However, the certification will be nullified if the SRM is damaged, contaminated, or modified.

The coordination of technical measurements for certification was accomplished under the direction of J.R. Sieber of the NIST Analytical Chemistry Division. Analytical measurements for certification of this SRM were performed by J.R. Sieber, A.F. Marlow, and P.R. Seo of the NIST Analytical Chemistry Division and by D. Broton, S. Nettles, M. Bharucha, and S. Padiyara of CTL, Skokie, IL.

Statistical consultation for this SRM was provided by S.D. Leigh of the NIST Statistical Engineering Division.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by B.S. MacDonald.

Willie E. May, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 19 November 1999

Thomas E. Gills, Director
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Stability: This material is considered to be stable during the period of certification. NIST will monitor this material and will report any significant changes in certification to the purchaser. Return of the attached registration card will facilitate notification.

Use and Handling: Because cement powder is hygroscopic, the following procedure is recommended. Samples should be used immediately after opening. To relate analytical determinations to the certified value in this Certificate of Analysis, a minimum sample mass of 500 mg should be used. The vial should be recapped immediately and stored in a desiccator over magnesium perchlorate or phosphorus pentoxide. When a sample is taken after storage in a previously opened vial, the LOI for that sample should be determined in accordance with ASTM C114 and the mass of the sample corrected for any gain or loss of moisture relative to the LOI value reported in this certificate.

Calibration of X-Ray Methods: To obtain the most accurate results by x-ray fluorescence methods of analysis, it is recommended that the user employ calibration procedures utilizing corrections for inter-element effects to minimize biases. Alternatively, the user may compare samples to the particular SRM that most closely matches the samples in overall chemical composition.

Reporting: Elements are reported as their oxide forms to conform with the practice set forth in ASTM C 114-97 Standard Test Methods for Chemical Analysis of Hydraulic Cement.

Table 1. Certified Values for SRM 1883a Calcium Aluminate Cement

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
SiO ₂	0.24 ± 0.09	MgO	0.19 ± 0.01
Al ₂ O ₃	70.04 ± 0.57	Na ₂ O	0.30 ± 0.01
Fe ₂ O ₃	0.078 ± 0.004	K ₂ O	0.014 ± 0.001
CaO	29.52 ± 0.86		

The uncertainty listed with each certified value is an expanded uncertainty based on a 95 % confidence interval [3] calculated as $U = ku_c$ where u_c is the combined standard uncertainty and $k = 2$ is a coverage factor. The expanded uncertainty is calculated by combining a between-method variance [4] with a pooled, within-method variance in accordance with the ISO/NIST Guide to the Expression of Uncertainty in Measurement [5].

Table 2. Reference Values for SRM 1883a Calcium Aluminate Cement

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
TiO ₂	0.020 ± 0.002	Cr ₂ O ₃	0.006 ± 0.001
SrO	0.019 ± 0.002		

The uncertainty listed with each reference value is an expanded uncertainty based on a 95 % confidence interval [3], calculated as $U = ku_c$ where u_c is the combined standard uncertainty and $k = 2$ is the coverage factor. The combined standard uncertainty is derived by combining an ordinary precision uncertainty with an estimate including known sources of bias.

Table 3. Information Values for SRM 1883a Calcium Aluminate Cement*

Constituent	Mass Fraction (%)	Mass Fraction (%)	
Mn ₂ O ₃	0.003	LOI at 950 °C	0.35
P ₂ O ₅	0.003		

*For this SRM, the total of the reported oxides plus the LOI is 100.78 %.

REFERENCES

- [1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).
- [2] ASTM C 114-97, Standard Test Methods for Chemical Analysis of Hydraulic Cement, *Annu. Book ASTM Stand.* **Vol. 04.01**, West Conshohocken, PA.
- [3] Hahn, G.J., and Meeker, W.Q., "Statistical Intervals: A Guide for Practitioners," John Wiley & Sons, Inc., New York, (1991).
- [4] Rukhin, A.L. and Vangel, M.G., "Estimation of a Common Mean and Weighted Means Statistics," J. Amer. Stat. Assoc. (JASA), **93** (441), pp. 303-308, (1998).
- [5] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, U.S. Government Printing Office, Washington DC, (1994); (available at <http://physics.nist.gov/Publs/>).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: Telephone (301) 975-6776 (select "Certificates"), Fax (301) 926-4751, e-mail srminfo@nist.gov, or via the Internet <http://ts.nist.gov/srm>.